

Substitute Claims (clean version)

1.) A method of forming a web of fibrous media comprising: feeding first fibers in attenuated multiple fiber layers from a first spaced orifice zone in a first feed path to a first spaced longitudinally extending rotating collector zone in successive lower and upper fiber layers, said fibers having a first selected fiber size distribution when passed to said first collector zone to form a first fibrous mat having a first selected fiber size distribution thereon; feeding said first formed fibrous mat to at least a second similarly rotating collector zone spaced from said first rotating collector zone; feeding second fibers in attenuated multiple fiber layers from a second spaced orifice zone in a second feed path to said second collector zone spaced from said second orifice zone to form a second fibrous mat combined with said first fibrous mat fed to said second collector zone from said first collector zone, said second fibers having a second selected fiber size distribution and, feeding said combined fiber mat from said second collector source zone to a further mat forming zone.

2.) The method of forming a web of fibrous media of Claim 1, wherein said first and second collector zones are selectively spaced from said first and second orifice zones respectively and said first and second fiber feeds paths are fed at selected locations and at selected angles to said rotating collector zones respectively so as to control at least one outer surface of said combined filter mat passed to said mat forming zone.

3.) The method of forming a web of fibrous media of Claim 1, wherein said attenuated multiple fiber layers from said first and second orifice zones are attenuated at selected spaces, volumes, and air pressures from said respective orifice zones.

4.) The method of forming a web of fibrous media of Claim 1, wherein third fibers are fed in attenuated multiple fiber layers from at least a third spaced orifice zone in a third feed

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path to a third rotating collector zone spaced from said third orifice zone to form a third fibrous mat to be combined with said first and second fibrous mat to be fed to said mat forming zone.

5.) The method of forming a web of fibrous media of Claim 4, wherein said first, second and third collector zones are rotated in the same direction.

6.) The method of forming a web of fibrous media of Claim 1, wherein said first and second collector zones are rotated in opposite directions so as to control both outer surfaces of said combined filter mat passed to said mat forming zone.

7.) The method of forming a web of fibrous media of Claim 6, wherein said first and second fiber feed paths to said first and second rotating collectors are directed to similar collector cross-sectional locations on said first and second rotating collectors.

8.) The method of forming a web of fibrous media of Claim 6, wherein said first and second fiber feed paths are directed to opposed different collector cross-sectional locations on said first and second rotating collectors.

9.) The method of forming a web of fibrous media of Claim 1, wherein said first and second collector zones are each rotated in the same direction with the fibers in said first and second feed paths being directed to different selected collector cross-sectional locations on said first and second rotating collectors respectively so as to control both outer surfaces of said combined filter mat passed to said mat forming zone.

10.) The method of forming a web fibrous media of Claim 2, wherein said first and second collector zones are selectively spaced from said first and second orifice zones respectively a selected distance in the range of two (2) to sixty (60) inches.

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11.) The method of forming a web of fibrous media of Claim 2, wherein said first and second collector zones are advantageously spaced a distance of approximately eighteen (18) inches from said first and second orifice zones respectively.

12.) The method of forming a web of fibrous media of Claim 2, wherein said first and second fiber feed paths are attenuated from said first and second orifice zones respectively in a downwardly directed manner to said first and second rotating collector zones respectively to each tangentially about a selected cross-sectional peripheral side of said first and second rotating collector zones respectively.

13.) A method of forming a web of fibrous media comprising: feeding first fibers in attenuated multiple fiber layers from a first spaced orifice zone to a first selectively spaced longitudinally rotating collector zone in successive lower and upper fiber layers, said fibers having a first fiber size distribution in the approximate range of zero point one (0.1) to twenty seven (27) micrometers to form a first fibrous mat having a first selected fiber sized thereon; feeding said first formed fibrous mat from said first rotating collector zone to at least a second similarly rotating collector zone spaced from said first rotating collector zone; feeding second fibers in attenuated multiple fiber layers from a second spaced orifice zone in a second feed path to said second collector zone selectively spaced from said second orifice zone to form a second fibrous mat combined with said first fibrous mat fed to said second collector zone from said first collector zone, said second fibers having a second fiber size distribution of approximately one (1) to fifty (50) micrometers, said fibers being attenuated from said first and second orifice zones at an approximate permeability of thirty (30) to four thousand (4000) cubic feet per minute per square foot (cfm/ft²) and said first and second orifice zones being spaced from said first and

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second collector zones respectively an approximate distance of eighteen (18) inches; and,

feeding said combined fiber mat from said second collector zone to a further mat forming zone.

14.) The method of forming a web of fibrous media of Claim 1, wherein said first and second select fibers in said first and second orifice zones respectively are of different selected fiber size distributions.

15.) The method of forming a web of fibrous media of Claim 1, wherein said first and second fibers in said first and second orifice zones are of different selected fiber size distribution in the approximate range of zero point one (0.1) to fifty (50) micrometers.

16.) The method of forming a web of fibrous media of Claim 1, wherein said first and second fibers in said first and second orifice zones respectively are in the approximated fiber size distribution first and second ranges of zero point (0.1) to twenty seven (27) and one (1) to fifty (50) micrometers, respectively.

17.) The method of forming a web of fibrous media of Claim 1, wherein said first and second fiber size distributions are intercombined when passed to said third mat forming zone.

18.) The method of forming a web of fibrous media of Claim 1, wherein said first and combined second fibrous mats are formed to be superposed one upon the other when passed to said third mat forming zone.

19.) The method of forming a web of fibrous media of Claim 1, wherein said first formed fibrous mat is fed from said first collector zone to said spaced second collector zone through a mat orientation zone extending between said spaced first and second collector zones.

20.) The method of forming a web of fibrous media of Claim 1, including the step of exerting an external relatively vertically creating force at a selected location on at least a portion of one of said first and second attenuated feed paths as said fibers approach a longitudinally

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extending collector zone with said fibers eventually forming on said immediately preceding rotating collector zone having the greater mat permeability.

21.) A method of forming a web of fibrous filter media comprising: feeding in a first feed zone first filter fibers of melt blown composition from first spaced melt blow orifices, said first filter fibers having a permeability in the approximate range of five (5) to two thousand (2000) cubic feet per minute per square foot (cfm/ft²) and a fiber size distribution in the approximate range of zero point one (0.1) to twenty seven (27) micrometers, said first filter fibers being fed to a first rotating collector zone in successive lower and upper fiber layers in said first zone so as to form a first portion of a combined filter mat; passing said first portion of said combined filter mat through a filter mat orientation feed zone to a second spaced similarly rotating collector zone to peripherally collect thereon in selected position between the first and fourth cross-sectional quadrants of said second spaced similarly rotating collecting zone; feeding in a second feed zone second filter fibers of melt blown composition from second spaced melt blown orifices, the filter fibers in both collector zones having a permeability in the approximate range of thirty (30) to four thousand (4000) cubic feet per minute per square foot (cfm/ft²) and a fiber size distribution in the approximate rate of one (1) to fifty (50) micrometers, said second filter fibers being fed to said second spaced collector zone source in successive lower and upper fiber layers in said collector second zone to form a second portion of said combined filter mat overlying said first portion of said filter mat fed in oriented form to said second collector zone; and, passing said combined mat formed of overlying first and second portions to a further work zone.

22.) A mat of fibrous media comprising: at least a first layered mat portion of selected first fiber size distribution and permeability and at least a second layered mat portion of selected

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second fiber size distribution and permeability both said first and second layered mat portions being of substantially aligned fibers of first and second selected fiber size distributions and permeabilities with each being attenuated as layers from spaced orifice sources directly to separate, spaced similarly rotating collector sources with one of such sources receiving said layered mat portion from the other immediately preceding spaced rotating collector source.

23.) The mat of fibrous media of Claim 22, wherein said first and second layered mat portions are combined in an interspersed manner.

24.) The mat of fibrous media of Claim 22, wherein said first and second layered mat portions are combined in a successive manner.

25.) The mat of fibrous media of Claim 22, wherein at least one portion of said layered portions is a product of turbulently entangled fibers with varied fiber size distribution.

26.) The mat of fibrous media of Claim 22, wherein said fibers of said first layered portion are of melt blown composition and said fibers of said second layered portion are of melt blown composition.

27.) The mat of fibrous media of Claim 22, wherein said fibers of said first layered portion are of a fiber fiber size distribution in the approximate range of zero point one (0.1) to twenty seven (27) micrometers and said second layered portion are of a fiber fiber size distribution in the approximate range of one (1) to fifty (50) micrometers.

28.) The mat of fibrous media of Claim 23, wherein said fibers of said first layered portion are in the approximate permeability range of five (5) to two thousand (2000) cubic feet per minute per square foot (cfm/ft²) permeability and said fibers of said second layers are in the approximate permeability range of thirty (30) to four thousand (4000) cubic feet per minute per square foot (cfm/ft²) permeability.

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29.) A mat of fibrous filter media comprising: at least a first layered filter media mat portion of synthetic melt blown composition with approximate fiber fiber size distributions being in the approximate range of zero point one (0.1) to twenty seven (27) micrometers and a permeability in the approximate range of five (5) to two thousand (2000) cubic feet per minute (cfm/ft²) and, a second successive layered filter media mat portion of synthetic melt blown composition with fiber fiber size distributions being in the approximate range of one (1) to fifty (50) micrometers and permeability in the approximate range of thirty (30) to four thousand (4000) cubic feet per minute per square foot (cfm/ft²), each layered portion having been attenuated as layers from selectively spaced melt blown orifice sources to separate spaced collector sources with one of such sources receiving said layered mat portion from the other immediately preceding collector source.

30.) Apparatus for manufacturing a fibrous mat comprising a first die source including spaced die orifices capable of feeding a first attenuated multiple fiber layered portion; a first selectively gap spaced longitudinally extending first rotating collector surface to receive said first layered portion; a spaced second die source including spaced die orifices capable of feeding a second attenuating multiple fiber layered portion; a second gap spaced longitudinally extending second similarly rotating collector surface to receive said second fiber layered portion, said second rotating collector surface being spaced from said first rotating collector surface; and transfer and orientation means positioned between said first and second collector surfaces to orient and transfer said first layered mat portion from said first rotating collector surface from a selected first cross-sectional quadrant to a selected second cross-sectional quadrant of said second similarly rotating collector surface.

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31.) The apparatus for manufacturing a fibrous mat of Claim 30, and at least one layered mat diverting apparatus positioned externally of one of said die sources to apply an external vortically creating force on part of one of said fiber layered portions before said portion reaches said cooperative rotating collecting source for said layered portion.

32.) Apparatus for manufacturing a fiber filter mat comprising: a first melt blown die source including spaced die orifices capable of feeding a first attenuated multiple filter fiber layer portion; a first longitudinally extending rotatable collector surface spaced from and aligned with said first die source to eventually receive said first attenuated filter fiber portion; a space second melt blown die source including spaced die orifices capable of feeding a second attenuated multiple filter fiber portion; a second longitudinally extending similarly rotatable collector surface spaced from and aligned with said second die source to receive said second attenuated filter fiber portion, said first die source and said aligned first rotatable collector being spaced from said second die source and said aligned second similarly rotatable collector; a plurality of spaced longitudinally extending idler rolls positioned between said first and second rotatable collectors to orient and transfer said first layered mat portion from said first rotatable collector surface from a first selected cross-sectional quadrant to a second selected cross-sectional quadrant of said second similarly rotatable collector surface; and at least one small collector diverter positioned in spaced relation to one of said die sources to apply an external vortically creating force to part of one of said fiber layered portions before said portion reaches said cooperative rotatable collector collecting surface for said portion, and, an additional work station positioned downstream said second rotatable collector to receive combined first and second mat portions.